

Unit 6: Momentum and Force

Quiz → F 4/25

Test → T 4/29

Momentum:

- Momentum = (mass)(velocity)
 - increase or decrease either mass or velocity to change momentum
 - $\vec{p} = m\vec{v}$
 - units: mass \rightarrow kg
velocity \rightarrow m/s
momentum \rightarrow kg·m/s
- Law of Conservation of Momentum
 - Total momentum of a system is conserved

(system is all the objects you have)

- For this class, we have:
 - Collisions in 1-dimension
 - 1st object stops immediately upon impact and 2nd object begins moving upon impact
- Equation: $\vec{p}_i = \vec{p}_f$ (of system)

$$\vec{p}_{1i} + \vec{p}_{2i} = \vec{p}_{1f} + \vec{p}_{2f}$$

$$\vec{p}_{1i} = \vec{p}_{2f}$$

$$m_1 \vec{v}_{1i} = m_2 \vec{v}_{2f}$$

- Impulse - Momentum Theorem:

$$\overline{F} t = \overline{p}$$

$$\overline{F} t = m \overline{v}$$

$$\overline{F} = m \left(\frac{\overline{v}}{t} \right)$$

$$\overline{F} = m \overline{a}$$

$F \rightarrow$ force
 $t \rightarrow$ time
 $p \rightarrow$ momentum

$$\overline{a} = \frac{\overline{v}}{t}$$

• Newton's Laws:

1. Object in motion stays in motion
or an object at rest stays at rest
unless acted upon by an unbalanced
force.

- Inertia \rightarrow property of an
object to resist change in motion

- Inertia depends on object's mass

2. Sum of forces = (mass)(acceleration)
(in one direction)

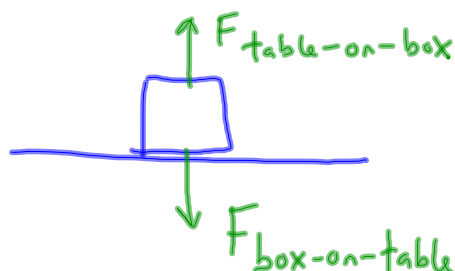
$$\sum \vec{F} = m\vec{a} \quad \Sigma \rightarrow \text{Greek capital Sigma}$$

$$\vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \dots = m\vec{a} \quad \text{stands for "sum of"}$$

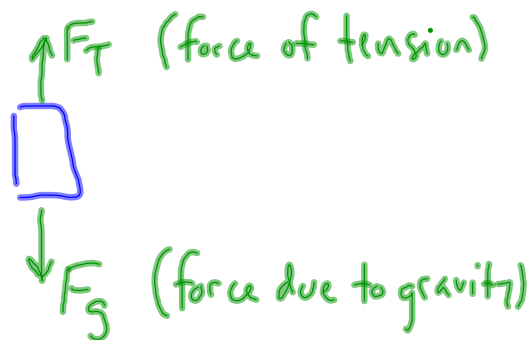
- Units: mass \rightarrow kg
acceleration \rightarrow m/s²
force \rightarrow kg·m/s² \rightarrow newton (N)

3. Forces come in pairs

(For every action there is an equal but
opposite reaction.)



- Free-Body Diagrams (FBDs)
 - Way to draw objects and forces to show what is happening
 - Example: Box being lifted by a rope



- To get acceleration, there must be unbalanced forces.
 - Acceleration will be in the direction of the larger force
 - If forces are equal in magnitude but opposite in direction, object will not accelerate.

(either object is moving at a constant velocity or object is not moving at all)